

# Chemistry 131

## Syllabus

### TEXTBOOK:

Introductory Chemistry: A foundation by Zumdahl

### MISSION STATEMENT

Southern University at Shreveport, an institution within the Southern University System, seeks to provide a quality education for its students, while being committed to the total community. This institution prepares students for careers in technical and occupational fields; awards certificates and associate degrees; and, offers courses and programs that are transferable to other colleges and universities. Dedicated to excellence in instruction and community service, this open enrollment institution promotes cultural diversity, provides developmental and continuing education, and seeks partnerships with business and industry.

### COURSE DESCRIPTION

Chemistry 131 is the second semester of the general chemistry course. Students enrolled in 131 should have successfully completed Chemistry 130 (the first semester of the course).

Since this is a continuation course, the Chemistry Department strives to make a smooth transition by emphasizing the conceptual approach to slightly more advanced topics. It is assumed at this time that students have an understanding of the fundamentals of writing formulas, balancing simple equations, using the metric system, and solving stoichiometry problems.

This course of general chemistry must include a good deal of written chemistry. Chemical symbolism, equations, problem solving, etc., require much written practice for proficiency. One does not become an accomplished pianist by merely reading or listening to music --it takes practice. One does not become a good baseball player by reading the rules and watching baseball games, it takes practice.

### COURSE OBJECTIVES

For a passing grade in this course, a student should be able to demonstrate the following objectives with 70% proficiency on problem sets and examinations:

#### Chemical Bonding

1. Define the terms ionic bond, the octet rule, electron-dot symbol, covalent bond, polarcovalent bond, and bond length.
2. Write electron-dot symbols for common atoms and ions.
3. Describe the formation of a covalent bond between two non-metallic atoms.
4. Given the molecular formula of a small molecule, draw the molecule's electron dot structure.
5. Describe the valence shell electron-pair concept model for predicting molecular shape.
1. Explain what is meant by linear, trigonal planar, and tetrahedral arrangements and give one example of each.

#### The Gaseous State

1. Describe the properties shared by all gases.
2. Describe atmospheric pressure and its units of measurements.
3. Name the theory that explains the behavior of real gases.

4. Explain Boyle's law, Charles law, Avogadro's law using the kinetic molecular theory of gases.
5. Combine Boyle's, Charles and, Avogadro's law into a single law describing the behavior of ideal gas.
6. Given the partial pressure of each component in a gas mixture, find the total pressure.
7. Given the mass of reactants, calculate the volume of a gas released during a reaction.

#### **Liauids. Solids. and attraction between Molecules**

1. Describe the states of matter
2. Define the role of heat and temperature on the changes in the states of matter.
3. Define the molar heat of fusion and the molar heat of vaporization.
4. Discuss the evaporation in terms of vapor pressure.
5. Use the kinetic molecular theory to explain the differences between the three states of matter.
6. Describe the nature of the forces between the molecules of a liquid.
7. Explain the nature of the forces between atoms, molecules, or ions in solids.

#### **Solutions**

1. Define the terms unsaturated solution, supersaturated solution, molarity, normality, osmosis, molality, solubility, solute, solvent, dilute solution and concentrated solution.
2. List examples of solutions in all three states of matter.
3. Know the methods of expressing concentrations of solutions and be able to perform calculations using these definitions.
4. Be able to discuss the effect of temperature change on the solubility of solids and gases in liquids.
5. Be able to calculate the molarity, molality, and percent solute of a solution.
6. Describe how the different ends of a polar molecule water are attracted to anions and cations.

#### **Acids and Bases**

1. Know Arrhenius, Bronsted-Lowry, and Lewis definitions of acids and bases.
2. Be able to identify Bronsted -Lowry conjugate acid-base pairs in simple base-acid equations.
3. Define acidic, neutral, and basic solutions in terms of the concentrations of hydronium ions in mol/L.
4. Given the hydronium ion concentration of a solution, calculate the hydroxide-ion concentration.
5. Calculate pH from  $[H_3O^+]$  and  $[H_3O^+]$  from pH; describe two techniques for measuring pH.

#### **Chemical Equilibrium**

1. Be able to define reversible reaction, equilibrium, catalyst, equilibrium constant, ionization constant, solubility product constant.
2. Use LeChatelier's principle to predict the direction in which equilibrium will shift because of changes in concentration, volume and temperature.
3. Know how to calculate values for equilibrium concentrations when initial concentrations are given.
4. Be able to explain the effect on an equilibrium reaction caused by changes in concentration, pressure, temperature, or catalyst.

#### **Oxidation-Reduction Reactions .**

1. Define oxidation, oxidizing agent, reduction, and reducing agent.
2. Given a reaction between a metal and a nonmetal, identify the oxidizing agent and the reducing agent.
3. Describe the relative reactivities of some of the elements in the activity series.

4. Predict which metals will dissolve in acids.
5. Given a molecule, formula unit or polyatomic ion, assign an oxidation number to each atom.
6. Balance oxidation-reduction equations by the oxidation-number method.
7. Balance oxidation-reduction equations by the half-reaction method.

### **Organic Chemistry**

1. Be able to classify hydrocarbons (as alkanes, alkenes, etc.), and name alkanes, alkenes, and alkynes of up to ten carbon atoms.
2. Be able to write structural formulas for organic compounds from names or molecular.
3. Know the definition for each of the three types of isomers and be able to write structural formulas for all isomers for any given organic compounds.
4. Be able to recognize and name the functional groups (alcohols, acids, etc.) and to give simple examples of these classes of compounds.

### **Biochemistry**

1. Know the principal components of cells and the role of water in living organisms.
2. Know the general formula for amino acids and the main structural characteristics of proteins.
3. Know the three classes of carbohydrates, and their functions.
4. Know the kinds of substances that are classified as lipids.

### **EVALUATION**

1. Grading: The following grade scale will be used in assigning grades.  
90 --100% = A  
80 --89% = B  
70 --79% = C  
60 --69% = D  
Below 59% = F
2. Methods of Evaluation
  - A. Quizzes
  - B. Assigned problems and homework
  - C. Examinations (5 or 6 one hour exams)
  - D. Final Examination (Comprehensive)

### **Conference Hours**

Conference hours for each instructor have been arranged according to teaching schedule. If a student cannot meet with said instructor during scheduled conference periods, the student should arrange a time with the instructor that is convenient for both. A schedule for conference periods is posted on the office door.

### **GENERAL INFORMATION:**

Attendance Requirements and Methods of Instruction:

You must attend all lectures and laboratories, as this will enhance the learning process. Attendance is particularly important for laboratory periods as this forms the practical (hands-on) basis of learning chemistry. Absences will be excused for tests only in the case of documentable illness (the instructor reserves the right to demand proof of illness, i.e., a note from your doctor), family emergencies, or activities approved in advance with the instructor. Other reasons may be considered upon request. It is your responsibility to inform and make arrangements with the instructor if you are absent otherwise the absence will be unexcused. Unannounced quizzes (pop quizzes) will be given periodically, usually at the

beginning of class. The quizzes will cover the material discussed in the previous lecture and the reading assignment for that day. No make-up pop quizzes will be given.

In individual cases, it is inevitable that absences will occur. Each student is allowed three absences without penalty. If a student has accumulated more than three absences due to illness or extreme circumstance he should secure an authentic excuse. Class cutting does not constitute a valid excuse. In all cases the student is still held responsible for all work missed during the period of absence. If an examination has been given it is the responsibility of the student to arrange with the instructor for a make-up exam immediately upon returning to class.

Lectures will cover material in the text as indicated in the syllabus or assigned by the instructor (the instructor reserves the right to modify this at any time), and therefore the appropriate material from the text must be studied before coming to class. Typically, any given lecture will cover the sections of the text following the sections discussed in the previous lecture; this reading assignment is assumed (in other words: read ahead). Assigned readings and lecture material will be the subject of quizzes. Class periods will consist of lecture, discussion, problem solving, demonstrations, and other methods suitable to the material.

You are expected to be full participants in Chemistry 131. We are dedicated to doing everything that is reasonable to help you learn the material. We present lectures and sections on time and within the appointed time slots, and we request that you show respect for your classmates and instructor by showing up to class on time and prepared.

Please feel free to ask questions about concepts that you do not understand. However, unnecessary talking during lecture or discussion or in any way causing disruptions will not be tolerated. Please turn off cell phones and stay in your seat during lecture or discussion unless it is absolutely necessary to leave.

## **COURSE OUTLINE**

### **I. Chemical Bonding**

#### **A. Ionic Bonds**

1. Forming an ionic bond from atoms ,
2. Ionic bond formation with electron-dot symbols

#### **B. Covalent Bonds**

1. Sharing of electron pairs
2. Electronegativity and polar covalent bonds
3. Writing electron-dot formulas

#### **C. Shapes of molecules**

1. Molecular structure
2. Arrangement of electron groups about the central atom

### **II. Liquids, Solids, and Attractions between Molecules**

#### **A. Macroscopic description of the states of matter**

1. The states of matter
2. Energy involved in changes of state :.
3. Vapor pressure and evaporation .

#### **B. The molecular explanation of reaction rates**

1. The kinetic molecular theory of gases. liquids and solids
2. The liquid state; solid state

### **III. Solutions**

- A. An introduction to solutions
  - 1. Some terms used to describe solutions
  - 2. Types of solutions
  - 3. General properties of solutions.
- B. Concept of solubility
  - 1. Saturated, unsaturated and supersaturated solutions
  - 2. The solution process
  - 3. Solubility rules for ionic substances
  - 4. Factors that affect solubility
- C. Solution concentration
  - 1. Mass percent of solute
  - 2. Molarity
  - 3. Molality
- D. Colligative properties
  - 1. Freezing point depression and boiling point elevation.
  - 2. Osmotic pressure
- IV. Reaction rates and Chemical Equilibrium
  - A. Reaction rates
    - 1. Collision theory and activation energy
    - 2. Factors affecting reaction rates
    - 3. The dynamic nature of chemical equilibrium
    - 4. The equilibrium expression and the equilibrium constant
    - 5. Using the equilibrium constant
    - 6. Heterogeneous equilibria
    - 7. LeChatelier's principle
- V. Acids and Bases
  - A. Acid-Base concepts
    - 1. A search for definitions: The Arrhenius concept
    - 2. Neutralization, salts, and net ionic equations
    - 3. The hydronium ion
    - 4. The Bronsted-Lowry concept
    - 5. The relative strengths of acids
    - 6. The relative strengths of bases.
    - 7. Water: An acid and a base '
  - B. Some quantitative aspects of acids and bases
    - 1. Acidic, neutral and basic solutions
    - 2. pH '
    - 3. Measuring pH
    - 4. Buffers
- VI. Oxidation-Reduction Reactions
  - A. Oxidation-reduction concepts
    - 1. Oxidation and reduction
    - 2. Activity Series
    - 3. Oxidation numbers
      - a. Assigning oxidation numbers.
      - b. Using oxidation numbers in chemical equations.
    - 4. Balancing oxidation-reduction equations by the oxidation number method

- 5. Balancing oxidation-reduction equations by the half-reaction method
- B. Electrochemistry
  - 1. Voltaic cells
  - 2. Electrolytic cells
  - 3. Three important batteries
    - a. Lead storage battery
    - b. Nickel-Cadmium battery
    - c. Mercury battery
- VII. Nuclear Chemistry
  - A. Radioactivity -
    - 1. The nuclear model
    - 2. Radioactive decay
      - a. Types of radioactive decay
      - b. Radioactive decay series
    - 3. Nuclear transmutation
    - 4. Rate of radioactive decay and half-life
  - B. Nuclear energy
    - 1. Nuclear fission
    - 2. Nuclear fusion
- VIII Organic Chemistry
  - A. Bonding and structure in organic compounds
    - 1. Carbon atom bonding
    - 2. Structural formulas and isomerism
    - 3. Condensed structural formulas
  - B. Hydrocarbons
    - 1. Alkanes
    - 2. Alkenes and alkynes
    - 3. Polyalkene polymers
    - 4. Aromatic hydrocarbons
  - C. Oxygen derivatives of hydrocarbons
    - 1. Alcohols and ethers
    - 2. Aldehydes and ketones
    - 3. Carboxylic acids and esters
  - D. Nitrogen derivatives of hydrocarbons
    - 1. Amines
    - 2. Amides and polyamides
- IX. Biochemistry
  - A. The cell
  - B. Proteins
  - C. Carbohydrates
  - D. Nucleic Acids and the Genetic Code
  - E. Lipids

**Conference Hours:**

Conference hours will be arranged according to teaching schedule. A schedule of available hours is posted on the office door.

**Cell Phones:**

Cell phone usage is prohibited in the classroom. If you bring your cell phone to class, it must be turned **OFF**. This class will **not** be disturbed by the ringing of your phone. **No excuses.**

**Disability Act**

All students with disabilities must notify the instructor for any needed assistance in compliance with the American Disability Act (ADA). In compliance with ADA policies, all qualified students enrolled in the course are entitled to "reasonable accommodations".

A student is required to show the instructor a paid receipt on the first day of class. **(Note –a student is not officially enrolled in class unless he or she has a stamped paid class schedule. It is the student's responsibility to ensure that all steps of the registration process have been completed before attending class.)**